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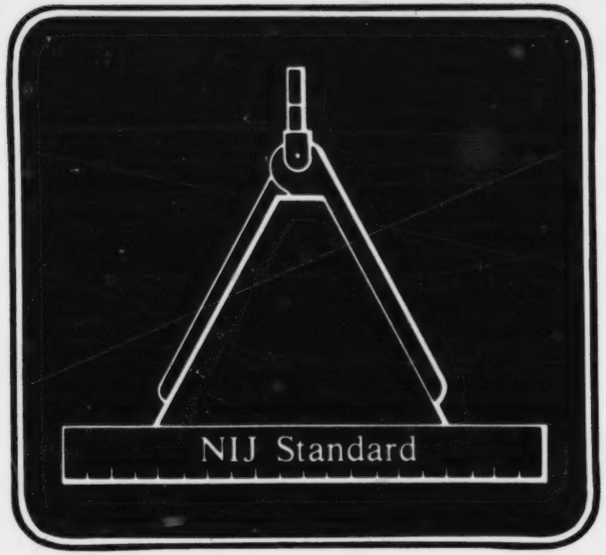
Microphone Cable Assemblies for Mobile FM Transceivers



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Technology Assessment Program

NIJ Standard for Microphone Cable Assemblies for Mobile FM Transceivers

A Voluntary National Standard Promulgated by the National Institute of Justice.

AUGUST 1980

U.S. DEPARTMENT OF JUSTICE
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Harry M. Bratt, Acting Director

ACKNOWLEDGMENTS

This standard was formulated by the Law Enforcement Standards Laboratory of the National Bureau of Standards under the direction of Jacob J. Diamond and Lawrence K. Eliason, successive Chiefs of LESL, and Marshall J. Treado, Program Manager for Communication Systems. NBS Electromagnetics Division staff members responsible for the preparation of the standard were Harold E. Taggart, project manager, Robert F. Jickling, Raymond N. Jones and Robert E. Nelson.

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NIJ STANDARD
FOR
MICROPHONE CABLE ASSEMBLIES
FOR MOBILE FM TRANSCEIVERS

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FOREWORD

Following a Congressional mandate* to develop new and improved techniques, systems, and equipment to strengthen law enforcement and criminal justice, the National Institute of Law Enforcement and Criminal Justice, now the National Institute of Justice (NIJ), established the Law Enforcement Standards Laboratory (LESL) at the National Bureau of Standards. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

In response to priorities established by NIJ, LESL is: (1) Subjecting existing equipment to laboratory testing and evaluation and (2) conducting research leading to the development of several series of documents, including national voluntary equipment standards, user guides, and technical reports.

This document, NIJ-STD-0217.00, Microphone Cable Assemblies for Mobile FM Transceivers, is a law enforcement equipment standard developed by LESL and approved and issued by NIJ. Additional standards as well as other documents are being issued under the LESL program in the areas of protective equipment, communications equipment, security systems, weapons, emergency equipment, investigative aids, vehicles and clothing.

This equipment standard is a technical document consisting of performance and other requirements together with a description of test methods. Equipment which can meet these requirements is of superior quality and is suited to the needs of law enforcement agencies. Purchasers can use the test methods described in this standard to determine firsthand whether a particular equipment item meets the requirements of the standard, or they may have the tests conducted on their behalf by a qualified testing laboratory. Law enforcement personnel may also reference this standard in purchase documents and require that any equipment offered for purchase meet its requirements and that this compliance be either guaranteed by the vendor or attested to by an independent testing laboratory.

The necessarily technical nature of this NIJ standard, and its special focus as a procurement aid, make it of limited use to those who seek general guidance concerning microphone cable assemblies for mobile FM transceivers. The User Guide Series is designed to fill that need. We plan to issue guides to various items of law enforcement equipment as soon as possible, within the constraints of available funding and the overall NIJ program.

The user guides being issued are highly readable and tutorial in nature in contrast to the standards, which are highly technical and intended for laboratory use by technical personnel. The guides provide, in non-technical language, information for purchasing agents and other interested persons concerning the capabilities of equipment currently available. They may then select equipment appropriate to the performance required by their agency.

NIJ standards are subjected to continuing review.** Technical comments and recommended revisions are invited from all interested parties. Suggestions should be addressed to the Program Manager for Standards, National Institute of Justice, U.S. Department of Justice, Washington, DC 20531.

Lester D. Shubin
Program Manager for Standards
National Institute of Justice

*Section 402(b) of the Omnibus Crime Control and Safe Streets Act of 1968, as amended.

**Prior to citing this standard or any other NIJ equipment standard, in a contract document the user should verify that the most recent edition is used. Write to: Chief, Law Enforcement Standards Laboratory, National Bureau of Standards, Washington, DC 20234.

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NIJ STANDARD FOR MICROPHONE CABLE ASSEMBLIES FOR MOBILE FM TRANSCEIVERS

1. PURPOSE AND SCOPE

The purpose of this standard is to establish requirements and methods of test for microphone cable assemblies used with mobile FM transceivers. The standard addresses the multiconductor cable and plug used to connect the microphone to the mobile transceiver control head. This standard is compatible with the other NIJ standards for mobile FM transceiver equipment [7,8,9,10,11].*

2. CLASSIFICATION

Microphone cable assemblies for mobile FM transceivers shall be of one class.

3. DEFINITIONS

The principal terms used in this document are defined in this section. Additional definitions relating to law enforcement communications are given in LESP-RPT-0203.00 [2].

3.1 Control Head

The assembly which contains the transceiver controls available to the operator, their circuitry, and receptacles for the microphone cable plug, the speaker cable plug and the transceiver control cable plugs.

3.2 Microphone Cable Assembly

A flexible multiconductor cable terminated by a cable plug at one end, and having exposed leads for connecting a microphone and a push-to-talk (PTT) switch at the other end.

4. REQUIREMENTS

4.1 Configuration

The microphone cable assembly shall consist of a retractile four-conductor cable 1.8 ± 0.3 meters (6 ± 1 feet) in extended length, terminated at one end with a microphone connector plug having the dimensions shown in figure 1. The color coding and pin numbering sequence shall conform with table 1.

TABLE 1. *Color code and pin designations*

Connector pin no.	Electrical function	Color of wire insulation
1	Microphone "Hi"	White
2	Microphone "Lo"	Green
3	Push-to-talk (PTT)	Red
4	Ground	Black

*The numbers in brackets refer to the references on page 6.

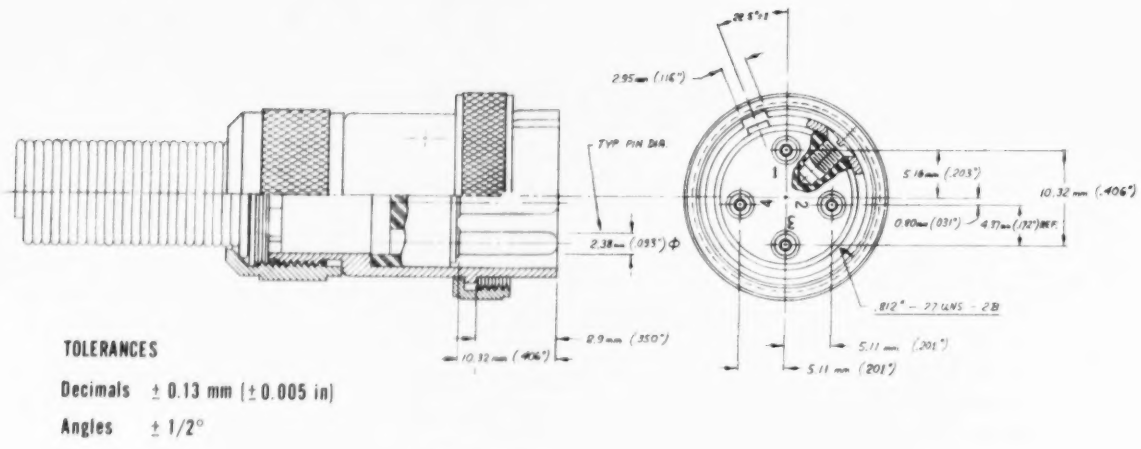

FIGURE 1. Microphone connector plug.

4.2 User Information

Manufacturers shall supply nominal values of the following:

a. Electrical resistance of each conductor
b. Electrical resistance of each conductor's insulation
c. Interconductor capacitances
d. The range of temperatures within which the equipment is designed to be operated.

4.3 Test Sequence

The microphone cable assembly shall be tested for the following requirements in the order given.

4.4 Mechanical Durability

After subjection to the mechanical durability test in accordance with paragraph 5.2, the microphone cable assembly shall show no visible signs of mechanical failure.

4.5 Vibration Stability

When tested in accordance with paragraph 5.3, no fixed part of the microphone cable assembly shall come loose. In addition, it shall meet the requirements of paragraphs 4.8 and 4.9 during the test.

4.6 Temperature Stability

The microphone cable assembly shall meet the requirements of paragraphs 4.8, 4.9 and 4.10 when tested at low and high temperature in accordance with paragraph 5.4. Low temperature tests shall be conducted at –30 °C (–22 °F) or the lowest temperature at which the manufacturer states (par. 4.2.d) that his unit will operate properly, whichever is lower, and high temperature tests shall be conducted at 60 °C (140 °F) or the highest temperature at which the manufacturer states (par. 4.2.d) that his unit will operate properly, whichever is higher.

4.7 Humidity Stability

The microphone cable assembly shall meet the requirements of paragraphs 4.9 and 4.10 when tested at high temperature and humidity in accordance with paragraph 5.5.

4.8 Conductor Resistance

When tested in accordance with paragraph 5.6, the resistance of each conductor, which includes the contact resistance of the microphone connector plug and receptacle, shall not exceed 300 milliohms. This test shall be conducted under the environmental conditions required by paragraphs 4.5 and 4.6.

4.9 Insulation Resistance

When tested in accordance with paragraph 5.7, the insulation resistance between each conductor and the connector shell, and between each two conductors of the cable assembly, shall be at least 500 megohms. This test shall be conducted under the environmental conditions required by paragraphs 4.5, 4.6 and 4.7.

4.10 Interconductor Capacitance

When tested in accordance with paragraph 5.8, the capacitance between each conductor and the connector shell, and between each two conductors of the cable assembly, shall not exceed 1500 pF. This test shall be conducted under the environmental conditions required by paragraphs 4.6 and 4.7.

5. TEST METHODS

5.1 Test Equipment

The test equipment described in this section is limited to that equipment which is the most critical in making the required measurements. All other test equipment shall be of comparable quality.

5.1.1 Environmental Chamber

The environmental chamber or chambers shall be capable of producing the temperatures and humidity required by paragraphs 4.6 and 4.7. The test items shall be shielded from air currents blowing directly from heating or cooling elements in the chamber. The temperature of the item under test shall be measured with a thermometer separate from the sensor used to control the chamber air temperature. Likewise, the humidity shall be measured with a hygrometer separate from the sensor used to control the humidity.

5.1.2 Test Receptacles

The test receptacle (with conductor leads) shall consist of a 4-contact connector receptacle that mates with the microphone connector plug, has the dimensions given in figure 2, and has a 15 cm (6 in) length of 16 gauge copper wire attached to each of the four conductor pins.

The test receptacle (with connector shell lead) shall consist of an identical receptacle which has no conductor leads but does have a lead attached to the connector shell, if one of the cable conductors is not so connected.

5.1.3 Megohmmeter

The megohmmeter shall be capable of measuring 500 megohms of dc resistance with an uncertainty not to exceed ten percent, using a test voltage of 100 volts.

5.1.4 Capacitance Bridge

The capacitance bridge shall be capable of measuring 1500 pF with an uncertainty not to exceed ten percent, using a test frequency of one kHz.

5.1.5 Voltmeter

The voltmeter shall have an internal resistance of at least 20,000 ohms and shall be capable of measuring 300 millivolts with an uncertainty not to exceed five percent.

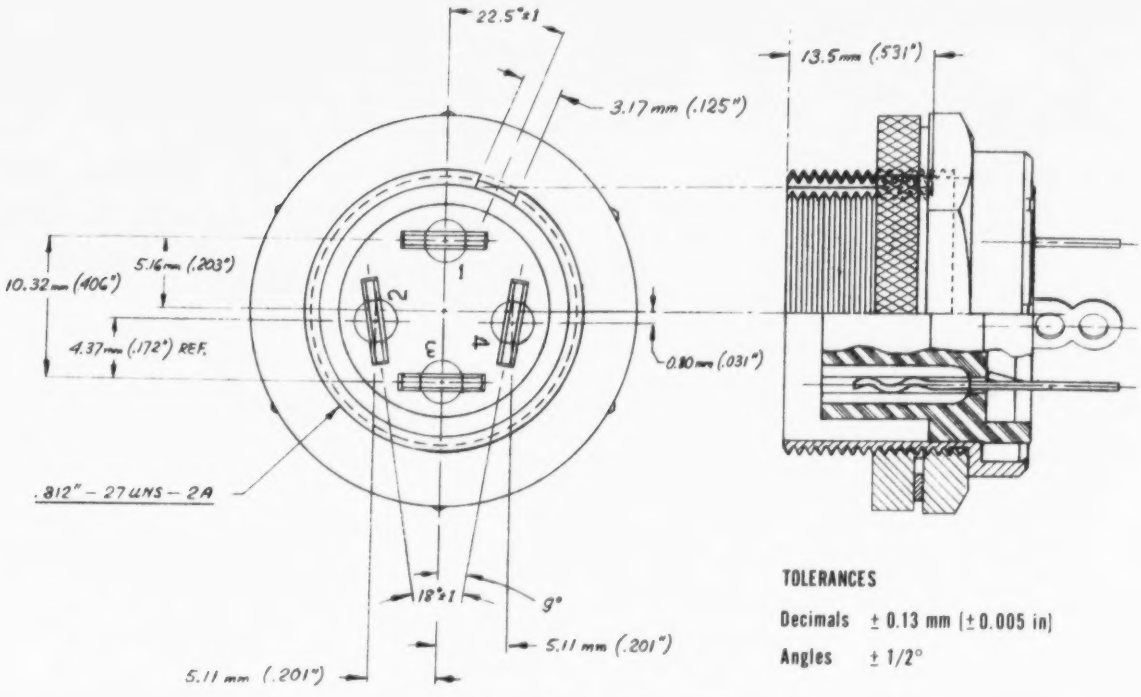

FIGURE 2. Microphone connector receptacle.

5.2 Mechanical Durability Test

Connect the microphone cable plug to a mating receptacle that has the dimensions given in figure 2 and then disconnect it. Perform this test sequence 200 times.

Reconnect the plug to the receptacle and fix the position of the receptacle. Connect the other end of microphone cable assembly to a microphone in accordance with the manufacturer's instructions or, in their absence, in accordance with good practice. Extend the microphone cable assembly to its specified length (par. 4.1) in such a manner that the extended cable is at right angles to the axes of symmetry of the connector and the microphone (which are kept parallel to each other), thereby flexing the cable ends through angles of about 90°. Perform this extension 1000 times, returning the cable to the retracted position after each extension.

5.3 Vibration Test

Secure the test receptacle (with conductor leads) to the shake table by a suitable bracket. Connect the microphone cable assembly to the test receptacle and lock the plug in place with the coupling ring. Fasten the other end of the retracted cable to a nonvibratory support adjacent to the shake table.

Perform a two-part test for a total of 30 minutes in each of two directions, namely the directions parallel to, and perpendicular to, the major axis of the connector pair.

First subject the item under test to three five-minute cycles of simple harmonic motion having an amplitude of 0.38 mm (0.015 inch) [total excursion of 0.76 mm (0.03 inch)] applied initially at a frequency of 10 Hz and increased at a uniform rate to 30 Hz in two and one-half minutes, then decreased at a uniform rate to 10 Hz in two and one-half minutes.

Then subject the item under test to three five-minute cycles of simple harmonic motion having an amplitude of 0.19 mm (0.0075 inch) [total excursion 0.38 mm (0.015 inch)] applied initially at a frequency of 30 Hz and increased at a uniform rate to 60 Hz in two and one-half minutes, then decreased at a uniform rate to 30 Hz in two and one-half minutes.

Repeat for the other direction and perform the conductor resistance test in accordance with paragraph 5.6 during the last five minutes of the vibration test.

Replace the test receptacle (with conductor leads) with the test receptacle (with connector shell lead). Repeat the above vibration test and perform the insulation resistance test in accordance with paragraph 5.7 during the last five minutes of the vibration test.

5.4 Temperature Test

Place the microphone cable assembly, connected and locked to the test receptacle (with conductor leads), in the environmental chamber. Permit up to 5 cm (2 in) of each conductor to protrude from the chamber for ease in connecting test equipment. Adjust the temperature of the chamber to the required low temperature ±2 °C (±3.6 °F). After the item under test has reached temperature equilibrium, maintain it at this temperature for 30 minutes, and then proceed in accordance with paragraph 5.6. Repeat the above procedure at the required high temperature ±2 °C (±3.6 °F).

Replace the test receptacle (with conductor leads) with the test receptacle (with connector shell lead) and permit up to 5 cm (2 in) of the test lead from the connector shell, if present, to protrude from the chamber. Repeat the above low and high temperature tests and proceed in accordance with paragraphs 5.7 and 5.8.

5.5 Humidity Test

Place the microphone cable assembly, connected and locked to the test receptacle (with connector shell lead), in the environmental chamber. Permit up to 5 cm (2 in) of each conductor on the cable assembly to protrude from the chamber for ease in connecting test equipment. The test lead from the connector shell, if present, may protrude to the same extent. Adjust the chamber to a temperature of 50°±2 °C (122°±3.6 °F) and a relative humidity of at least 90 percent. Maintain these conditions for at least eight hours and then, with the test item still in the chamber, proceed in accordance with paragraphs 5.7 and 5.8.

5.6 Conductor Resistance Test

Connect the equipment as shown in figure 3, choosing one of the conductors of the cable assembly for test. Connect the voltmeter so as to measure the sum of the voltage drops across the conductor under test, the connector plug and connector receptacle, but not the voltage drops across the conductor-to-ammeter and the conductor-to-power source connections.

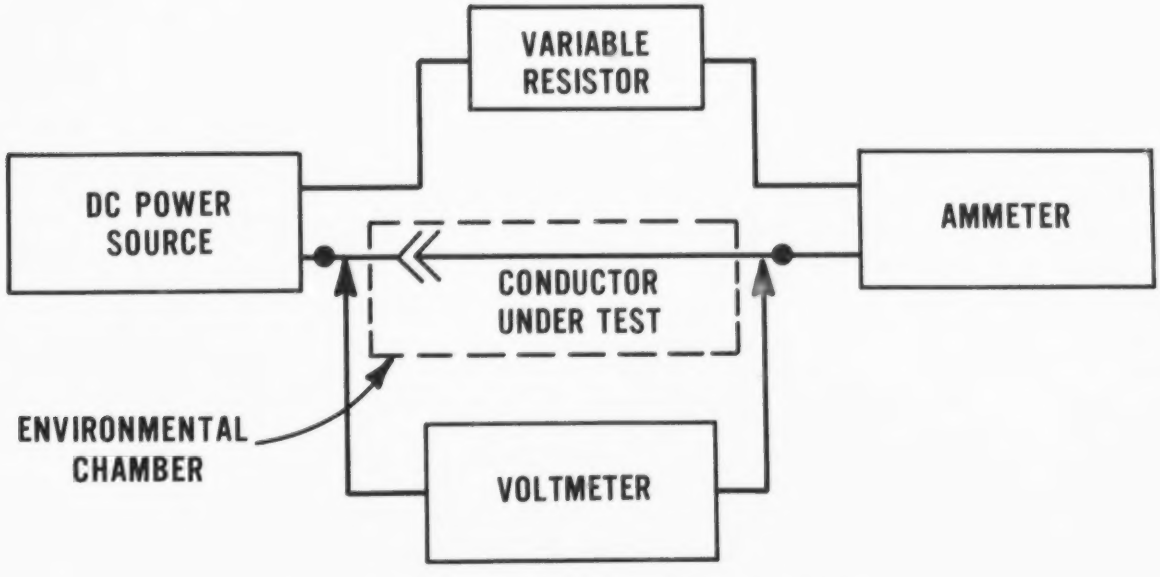

FIGURE 3. Block diagram for the measurement of conductor resistance.

Adjust the current through the conductor to one ampere. The voltmeter reading in millivolts is numerically equal to the required resistance in milliohms. Repeat the measurement for each of the other three conductors in the cable.

5.7 Insulation Resistance Test

Connect any two conductors of the microphone cable assembly to the megohmmeter and set the megohmmeter test voltage to 100 volts. Apply the test voltage for a period of one minute and then note the insulation resistance as indicated by the megohmmeter. Repeat the measurement for each of the other five conductor pair combinations. Repeat the insulation resistance test between each conductor and the connector shell (four measurements; three if one of the conductors is connected to the shell).

5.8 Interconductor Capacitance Test

Connect any two conductors of the retracted microphone cable assembly to the capacitance bridge and measure the capacitance between them at a frequency of 1 kHz. Then measure the interconductor capacitances of the other five conductor pair combinations. Finally, measure the capacitances between each conductor and the connector shell (four measurements; three if one of the conductors is connected to the shell).

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